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WHAT A GEOLOGIST CAN DO IN WAR

R. A. F. PENROSE, Jr.

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PREPARED BY
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FOR THE
GEOLOGICAL COMMITTEE
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INTRODUCTION

This brochure has been prepared for the purpose of stating succinctly and clearly the competency of the geologist in war service. It is commended to the attention of commanding officers.

JOHN M. CLARKE,

Chairman, Geology Committee,
National Research Council.

April 24, 1917.

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CONTENTS

	Page
General Statement	9
Camps	11
Trenches and Tunnels	14
Ground for Artillery Positions	16
Roads	17
Maps	18
Long Distance Observations	21
Water Supply	23
Vibration Effects	26
Other Qualities for Usefulness	27

WHAT A GEOLOGIST CAN DO IN WAR

General Statement

A knowledge of geology can be made of use in many ways in time of war, not only to the army in camp but to the army on the march and the army in battle. The ground on which an army camps, the ground which it traverses, the rocks on which heavy guns are placed, and the roads over which these heavy guns must be hauled, the ground in which trenches, tunnels and other openings for protection or storage are dug, the water supply for the army, and many other subjects are important matters in determining the success of military

operations, and in most of them the geologist has a special knowledge which can be of use to army officers.

The distribution and character of the rocks, their stratified or unstratified nature, their porosity, strength, elasticity, composition and other physical and chemical properties, all have a bearing on the welfare of an army and are all familiar to the geologist, but are outside the knowledge of most army officers. In the education of the army officer, the numerous matters of a military nature that demand his attention necessarily prevent him from studying these geological subjects, and yet a knowledge of them is of importance to the success of military operations.

Camps

The drainage of the camp and the sanitary arrangements are matters of great importance, and here the geologist, by his knowledge of the structure of the ground, can be of assistance. Dry and sufficiently high ground is, of course, desirable from a sanitary point of view, though from a strategic point of view perhaps it cannot always be occupied; and in places where military necessity requires a camp in a low, swampy place, there may be spots that are better drained than others, or where the character of the water is less objectionable and less infested with mosquitoes and other insects. A knowledge of the geology of a swamp is,

therefore, as important to the welfare of an army camp as a knowledge of mountains and plains.

A true comprehension of the topography and geology of arid regions, such as are found in our southwest, is often necessary for the safety of a camp, for many attractive-looking meadows are really the bottoms of dry creek beds, and before morning, storms in the mountains above may convert them into roaring torrents, sweeping everything before them. Hundreds of pioneers and others in our southwest have lost their lives in this way. Many of them knew the danger of camping in dry creek beds, but they did not grasp the topography of the country sufficiently to realize

that the convenient flat spots which they chose for camp were really in line of drainage channels, and hence in line of danger.

Trenches and Tunnels

The geologist, when circumstances permit, can locate the more easily worked and dryer formations for digging trenches and tunnels, and can thus often save not only unnecessary time and labor, but the calamity of wet trenches with the resulting rheumatism, pneumonia, tuberculosis and other diseases. He cannot always perform this service, for trenches must be dug where strategic necessity requires them, and, moreover, an army often cannot wait until the geologist makes his examination; but when opportunity permits, the geologist, more than anyone else, can be useful in this matter. An instance of how tunnels and underground openings can be kept dry, even among forma-

tions that are mostly wet, is shown remarkably in the case of the underground railways in London. The old original underground railways were dug near the surface, often in porous, water-bearing materials, and were damp and uncomfortable. The new underground railways, commonly known as the tube-railways, were made largely in the "London Clay," which formation, though underlaid and overlaid by wet strata, is itself so impervious to moisture that excavations made in it are comparatively dry. The result is that the tube-railways are dry and healthy passages. This instance is mentioned to illustrate how a knowledge of geology can affect the character of underground work.

Ground for Artillery Positions

The ground on which heavy artillery is to be stationed is of the utmost importance, for on its firmness, elasticity and other qualities depends to a large extent the accuracy of a gun's work. Here again the knowledge of the geologist is of importance, for to him the structure and the physical and chemical character of rocks have been a life study, while they are unknown quantities to men of most other professions.

Roads

The roads on which heavy artillery is to be moved must be far stronger than most roads. In fact, in America there are to-day probably few roads that could bear without damage the heavy artillery used now on the western front in Europe. In case of war, our wagon roads, and perhaps some of our railways, would have to be greatly strengthened to be serviceable. The selection of the rock and other materials to accomplish this result, the location of the quarries, their extent and their capacity for production, are all within the province of the geologist.

Maps

The geologist in his comprehension of the meaning of topographic, geologic and other maps, in other words in his ability to "read maps," can be of much service to army officers. All army officers of course are supposed to be able to understand topographic maps, but to them the contour lines mean only elevations and depressions on the surface of the country, in some places abrupt and in others more or less gently sloping. To the army officer ground is ground, hills are hills, and hollows are hollows. To the geologist, however, ground, hills and hollows have a varying significance. The character of the contour lines on the topographic map

may often give him a suggestion of the geological structure of the region and even of the probable nature of the rocks. In fact, if a geologist has even only a very general knowledge of the geology of a region, a contour map may give him a very definite idea of the character of the rocks or other formations comprising any certain district in that region; and if he has in addition a geologic map, his interpretation of conditions is still more accurate. This knowledge indicates to him the character of the mountains, hills and valleys, enables him to judge whether a valley probably consists of low swamps or dry meadows; whether the rivers are deep and diffi-

cult to ford, or shallow and easy to ford; whether they are swift and full of rapids, or slow and moving sluggishly.

Long Distance Observations

The special knowledge of the geologist enables him even without topographic, geologic or any other maps to see many things at a distance not apparent to others. Through his field-glasses he can look far ahead on the line of march, and can observe geological conditions and identify the most available passes over ridges or through mountain ranges; he can determine whether the slopes indicate underlying rocks which might make the passes smooth and easily traversed, or whether they indicate rocks which might offer abrupt and difficult impediments to the passage of an army; he can predict whether the slope on the other side of the range

is probably steeper or has a more gradual incline than on the near side, whether it is likely to be an open country or timbered, as well as many other features of practical importance to an army. Many a mountain pass might look desirable to one not familiar with its geology, while another pass, apparently more difficult, could be seen by the geologist to be much more available.

Water Supply

The geologist can often be of much service to an army in the question of water supply. In regions where surface waters are abundant and suitable for use, the geologist may not be needed, but where underground water has to be sought, his services become of importance. A study of the circulation of underground waters is as much a part of the education of a geologist as the study of the nature of rocks and minerals, of geological formations, of topographic and geologic maps and the various other matters already mentioned.

The surface of the ground in many regions, especially in the arid parts of our west and southwest, looks like

a dry and barren waste, but often at a depth of from a few feet to a few hundred feet, underground waters are circulating. The discovery of such waters would be of great value to an army, not only in giving them a local supply of clear, fresh water, independent of outside sources, but in saving the expense and the time of men and mules or motor trucks in hauling water from a distance, which, even after it reaches camp, may be hot, muddy and insipid. Underground waters of course cannot always be found, and even where they exist they are often too limited in quantity, or too great in depth, to be available under the circumstances of immediate necessity; but in many

places they do exist and could be reached by some form of portable boring machine. The knowledge of the geologist is essential in locating them.

Vibration Effects

The problems of landslides and snowslides in mountainous regions, due to vibrations caused by heavy cannonading, the possibility of the use of the seismograph in determining the distance of artillery fire, and many other allied subjects, are important matters for the geologist in studying his sphere of usefulness in the field of battle.